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| 09/601,958      | 08/10/2000  | JYOTI KIRON BHARDWAJ | WLJ.056             | 5262             |

7590 05/30/2003  
JONES VOLENTINE, LLC  
12200 SUNRISE VALLEY DRIVE  
SUITE 150  
RESTON, VA 20191

EXAMINER

HASSANZADEH, PARVIZ

| ART UNIT | PAPER NUMBER |
|----------|--------------|
|----------|--------------|

1763

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DATE MAILED: 05/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/601,958

Applicant(s)

BHARDWAJ ET AL.

Examiner

Parviz Hassanzadeh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 23 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1,3-24 and 29-49 is/are pending in the application.
- 4a) Of the above claim(s) 3,5,10,11,16-20,22-24 and 29-49 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,4,6-9,12-15 and 21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 August 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Election/Restrictions*

Applicant's election without traverse of Species 1, Group 1, claims 1, 2, 4, 6-9, 12-15, 21 and 26-28 in Paper No. 12 is acknowledged.

Claims 3, 5, 10, 11, 16-20, 22-24 and 29-49 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Species and method, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 12.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Claims 1, 4, 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0822582 A2) in view of Amemiya et al (EP 0488393 A2).**

Bhardwaj et al teach a plasma processing apparatus (Fig. 1) comprising:

a vacuum chamber 11 having a support 12 for a substrate 13;

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a gas inlet port 18 into the chamber through which deposition or etching gases can be introduced;

wherein the alternating reactive ion etching and depositing a passivation layer by chemical vapor deposition is performed, wherein one or more of the following parameters: gas flow rates, chamber pressure, plasma power, substrate bias, etch rate, deposition rate, cycle time and etching/deposition ratio vary with time (*means for alternately and repeatedly introducing an etch gas and a deposition gas into the chamber through the at least one gas inlet, wherein the deposition gas is different from the etch gas*); and

an RF source 16 coupled to the coil 15a (*means for striking a plasma into the etch and the deposition gas alternately introduced into the chamber*) (abstract, page 3, line 49 through page 4, line 17).

Bhardwaj et al fail to teach an attenuation means for reducing and/or homogenizing the ion flux from the plasma substantially without affecting the neutral radical number density.

Amemiya et al teach a plasma processing apparatus (Fig. 2) including an *ion trap* 38 for trapping ions in the plasma to send neutral radicals into the wafer treating section 24 (*attenuation means for reducing and/or homogenizing the ion flux from the plasma substantially without affecting the neutral radical number density*) (abstract and column 4, line 47 through column 5, line 35).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the ion trap as taught by Amemiya et al in the apparatus of Bhardwaj et al in order to send neutral radicals into the wafer processing section.

*Regarding claim 4:* the side wall of the chamber in inductively coupled plasma source are known to be made of a dielectric material such as quartz, for example, the upper section 26 of the apparatus of Amemiya et al is made of quartz (dielectric material) (column 5, line 1).

*Regarding claim 6:* as shown in Fig. 1 of Bhardwaj et al, the inductive antenna 15a is disposed around the chamber 11.

**Claims 1, 4, 6-9, 12, 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0822582 A2) in view of Ohkawa et al (EP 0831516 A2).**

Bhardwaj et al teach a plasma processing apparatus (Fig. 1) comprising:

a vacuum chamber 11 having a support 12 for a substrate 13;

a gas inlet port 18 into the chamber through which deposition or etching gases can be introduced;

wherein the alternating reactive ion etching and depositing a passivation layer by chemical vapor deposition is performed, wherein one or more of the following parameters: gas flow rates, chamber pressure, plasma power, substrate bias, etch rate, deposition rate, cycle time and etching/deposition ratio vary with time (*means for alternately and repeatedly introducing an etch gas and a deposition gas into the chamber through the at least one gas inlet, wherein the deposition gas is different from the etch gas*); and

an RF source 16 coupled to the coil 15a (*means for striking a plasma into the etch and the deposition gas alternately introduced into the chamber*) (abstract, page 3, line 49 through page 4, line 17).

Bhardwaj et al fail to teach an attenuation means for reducing and/or homogenizing the ion flux from the plasma substantially without affecting the neutral radical number density.

Ohkawa et al teach a plasma processing apparatus (Fig. 1) including a magnet 30 generating magnetic field parallel to the surface of the substrate for trapping ions in the plasma to send neutral radicals into the substrate (*attenuation means for reducing and/or homogenizing the ion flux from the plasma substantially without affecting the neutral radical number density*) (abstract and column 6, line 19 through column 8, line 2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the magnetic field generating device as taught by Ohkawa et al in the apparatus of Bhardwaj et al in order to send neutral radicals into the wafer processing section.

*Regarding claim 4:* the side wall of the chamber in inductively coupled plasma source are known to be made of a dielectric material such as quartz, for example, the vessel 12 is made of an insulating material (dielectric material) such as glass (column 6, lines 19-31).

*Regarding claim 6:* as shown in Fig. 1 of Bhardwaj et al, the inductive antenna 15a is disposed around the chamber 11.

*Regarding claim 7-9, 12, 21:* the magnetic field as taught by Ohkawa et al may be produced by a permanent magnet or an electro-magnetic device (column 7, lines 2-16).

**Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0822582 A2) in view of Ohkawa et al (EP 0831516 A2) as applied to claims 1, 4, 6-9, 12, 21 above, and further in view of Kin (JP61-39521 A).**

Bhardwaj et al in view of Ohkawa et al teach all limitations of the claim as discussed above except for the attenuation means (magnetic generating filed) comprising a tubular member carrying magnets.

Kin teaches a plasma processing apparatus including a pole-like electrode 101 having a plurality of magnets 103, 104, ... embedded therein wherein the electrode is inserted inside a plasma chamber 110 (abstract).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the magnetic arrangement as taught by Kin in the apparatus of Bhardwaj et al in view of Ohkawa et al in order to protect the magnets from plasma when the magnetic field generating device is disposed inside the plasma chamber.

**Claims 14, 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0822582 A2) in view of Ohkawa et al (EP 0831516 A2) as applied to claims 1, 4, 6-9, 12, 21 above, and further in view of Ribeiro (US Patent No. 4,769,101).**

Bhardwaj et al in view of Ohkawa et al teach all limitations of the claims as discussed above except for the attenuation means (magnetic generating field) is temperature controlled.

Ribeiro teaches a plasma processing apparatus (Fig. 1) including a magnet coil 51 cooled by a cooling system 52 having a cooling-fluid line 53 (column 6, lines 22-33).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement cooling mechanism as taught by Ribeiro in the apparatus of Ohkawa et al in order to control the temperature of the magnets particularly if it is desired to dispose the magnets inside the chamber.

**Claims 14, 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0822582 A2) in view of Ohkawa et al (EP 0831516 A2) as applied to claims 1, 4, 6-9, 12, 21 above, and further in view of Maeno et al (US Patent No. 6,060,836).**

Bhardwaj et al in view of Ohkawa et al teach all limitations of the claims as discussed above except for the attenuation means (magnetic generating field) is temperature controlled.

Maeno et al teach a plasma processing apparatus (Fig. 1) including permanent magnets 40 cooled by a water-cooled structure comprising a cooling water passage (not shown) within the central conductor 22 in order to remove heat generated by plasma and thus to protect the magnets (column 5, lines 60-65).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement cooling mechanism as taught by Maeno et al in the apparatus of Bhardwaj et al in view of Ohkawa et al in order to remove heat from the magnets particularly if it is desired to dispose the magnets inside the chamber.

#### ***Response to Arguments***

Applicant's arguments with respect to claim 1, 4, 6-9, 12-15, 21 have been considered but are moot in view of the new ground(s) of rejection.

Applicants assert that neither of the prior art of record teaches an apparatus including a means for alternately and repeatedly introducing an etch gas and a deposition gas which is different from the etch gas into the chamber.

The Examiner agrees that Bhardwaj et al (EP 0822582 A2) teach an apparatus wherein alternating reactive ion etching and depositing a passivation layer by chemical vapor deposition is performed, wherein one or more of the following parameters: gas flow rates, chamber pressure, plasma power, substrate bias, etch rate, deposition rate, cycle time and etching/deposition ratio vary with time (abstract).



***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

*Lagarde et al (US Patent No. 6,403,490 B1)* teach a plasma reactor including a series of magnets disposed between two parallel electrodes for oscillating electrons between magnetic poles;

*Watanabe (JP 2-118055 A)* teach a plasma reactor including a magnet 11 cooled by a cooling mechanism as shown in Fig. 1; and

*Okudaira et al (US Patent No. 4,985,114)* teach an apparatus wherein alternately etching and deposition gases are introduced into a reaction chamber at predetermined time intervals.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Parviz Hassanzadeh whose telephone number is (703)308-2050.

The examiner can normally be reached on Tuesday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (703)308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9310 for regular communications and (703)872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661.

*P. Hassanzadeh*  
Parviz Hassanzadeh  
Examiner  
Art Unit 1763

May 21, 2003